Large anisotropic single crystal epitaxial graphene flakes isolated from SiC wafers

Sofia Aslanidou, Alberto García-García, Elisabet Prats, Philippe Godignon, Gemma Rius
1 Institute of Microelectronics of Barcelona, IMB-CNM, CSIC, 08193, Bellaterra, Spain
2 Universitat Autònoma de Barcelona, UAB, 08193, Bellaterra, Spain

INTRODUCTION

High performance graphene electronic devices require high quality graphene obtained either by CVD on Cu foils or epitaxial graphene (EG) on SiO\(_2\). In this work, we report some preliminary results on the development of electronic devices based on large anisotropic single crystal EG flakes obtained on the C-face of SiC by high temperature sublimation\(^1\). The EG flakes were transferred to SiO\(_2\), substrate via PMMA-assisted electrochemical delamination technique\(^2\) and electrical contacts were aligned and patterned by e-beam lithography and lift-off process. Both structural and electronic characterization indicate that high crystalline quality of EG is basically preserved upon electrochemical transfer as well as device fabrication.

EPITAXIAL GRAPHENE DEPOSITION

SLG to FLG islands nucleating and growing on the step bunched SiC surface. Raman spectra acquired in the middle of C-face SLG graphene ribbons \(^2\).

SELECTIVE EXFOLIATION OF SLG/BLG BY ELECTROCHEMICAL DELAMINATION

Electrochemical exfoliation of isolated flakes of epitaxial graphene on SiC substrates.

MORPHOLOGICAL and STRUCTURAL CHARACTERIZATION of TRANSFERRED FLAKES

Low intensity D band and \(\mathbf{2D}\) and \(\mathbf{G}\) indicate the preserved high quality of monolayer epitaxial graphene, confirming the preservation of crystal quality upon delamination from SiC and transfer.

RESULTS of PRELIMINARY ELECTRICAL CHARACTERIZATION

- Electrical characteristics are based on 4-probe technique.
- The linear I-V relationship confirms the obtaining of ohmic contacts.

EXEMPLARY and INTERFACED ELECTRICAL DEVICES

Device 1: Specific SLG flakes were identified, localized and electrically-interfaced with dedicated metal contact designs.

Device 2: Three electronic devices were realized and electrically characterized. The electrical contacts were aligned and patterned simply by using e-beam lithography, thin film evaporation and resist lift off process.

Device 3: Back gated devices will be used in order to determine carrier\(^+\) mobilities. Finally, Reconfigurable devices based on epitaxial graphene could be achieved adding top-gate structure.

FUTURE WORK

The results presented in this poster are a preliminary study for the realization and application of epitaxial graphene in electronic devices. Further electrical tests will be performed for the precise evaluation of the electronic properties and potential electrical characteristics of the devices.

REFERENCES


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